Venus surface thermal emission at decimeter wavelength: observation and simulation

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Abstract: Presence thick clouds of sulphuric acid and large abundant of CO_2 gas in Venus atmosphere is a major hindrance to the surface studies using VIS/IR spectral region. This opened a vista of opportunities for microwave/radiowave remote sensing for Venus surface probing. Venus has been studied using ground-based radars and radio-telescopes since 1960s and later the induction of interferometry-based radio telescopes such as VLA, GMRT, etc, improved the overall quality of imaging over a wide spectral range of radio-frequency/wavelength under polarimetric condition. The ensemble analyses of all these ground-based radiometer observations of Venus showed a unique spectral variation of thermal emission with a gradual increase in the brightness temperature (Tb) from ~1 mm to ~6 cm and a monotonous decrease thereafter with increasing the wavelengths in the decimetre wavelength regime of microwave spectrum. The recent Venus observations using interferometry-based radio-telescopes, such as VLA and GMRT, further confirmed the reduction of Tb. An acceptable explanation for the reduction in Tb has not been established. This study examines the role of thermophysical properties of subsurface regolith of Venus in the reduction of Tb through microwave radiative transfer based simulation of thermal emission and measurements by using dedicated GMRT campaign over a wide range of wavelength from ~20 cm to 120 cm. Good agreement between Tb simulation and observation is arrived at all the GMRT wavelengths for higher values of imaginary part of dielectric property of regolith. This indicates the presence of a highly conducting subsurface layers may exist below the Venus surface basaltic soil of depth of about 1m or more. The details of GMRT campaign, simulations surface thermal emission, results of comparison, geological and chemical evolutions for the formation the highly conducting subsurface regolith layers will be discussed during the presentation.